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AGE, CHANGE AND THE ADAPTED LIFE[1]

By Dr. WM. de B. MacNIDER

KENAN RESEARCH PROFESSOR OF PHARMACOLOGY, THE UNIVERSITY OF NORTH CAROLINA

THE interest in ageing which has expressed itself here in such a happy and helpful fashion during the past two days is not new as an intellectual adventure. The application of such understanding is in the period of its anticipated commencement. To date it has not related itself to life in the form of a basic consideration of such a process on which and from which specific interpretations of the varied manifestations of life at different age periods may be considered. The average individual, too frequently the biologist and usually the pathologist, limits his interest and confines his intelligence of ageing to narrow categories of thought. He fails to appreciate the yearning of tissues for life and the amazing chemical and structural modifications they may participate in, even gross structural changes designated disease, in order to bring about organ adaptation and the adaptation of the individual as a whole to those changes which occur as the life span progresses. The certainty of the termination of this life span and the fact that all living things are concerned with it has stimulated the imagination of poets and philosophers. Their inquisitiveness has been either romantic or dominated by resignation and has not been demonstrably helpful. Another period which concerns itself with the facts of life is in its beginning, and as these facts accumulate through chemical, biological and psychical research the romance of life will find sound ground on which to express its related beauty. Ultimate resignation will become lost in an interest in the transitory prolongation and effectiveness of the different periods of the life span. The Browning concept of the "last of life for which the first was made" will assume tangible significance.

For centuries before Cicero's great statement concerning old age thought had been given to this state of man, but only in what may be designated recent

[1] An address at the Symposium on Ageing, Washington University Medical School, Saint Louis, March 24 and 25, 1944.

years has the subject of ageing been considered in a relatedly helpful fashion. Metchnikoff[2] and Minot[3] gave serious thought to the ageing process, not only as a change in form, the morphology of senescence, but the former investigator made suggestions for the prolongation of the life of man. He was not greatly concerned with the effectiveness and pleasant relatedness of this life as years were added to it. Such a projection of the life span into and by prolonging the senile state is not helpful to the individual or to the social organization of which he is a part. In recent years several monographs[4, 5, 6] have appeared that gather together information concerning ageing and the senile individual and have served to bolster up some interest of a rather detached and philosophical nature in life processes. The masterly volume of Child[7] on "Senescence and Rejuvenescence" stands as a contribution of an experimental scientific order in an attempt by such a method to gain an insight into the phenomenon of ageing. Real and durably satisfying interest of a lasting and accurate nature in these processes has in this country come about through the concern of the Josiah Macy Jr. Foundation and the hearty appreciation of this interest by Professor E. V. Cowdry, which has culminated in the publication of two editions of his book "Problems of Ageing."[8] Here one finds not poetry or delightful prose dealing with these problems but investigations by earnest scientists into the particularities of ageing which, when considered in a composite fashion, give great understanding of these changes as a whole in both animal and plant organizations. Likely certain of these important contributions came about not primarily as previously planned studies on ageing, but as the life of plants and animals was in the process of investigation, these factors of change with age insinuated themselves for detailed consideration. They forced the investigator to take an excursion into one of the many bypaths which develop during research and which if their significance is realized may lead to plateaus affording broad vision of problems that await solution of greater worthwhileness than the meticulous problem which prompted the initial investigation. The factors of age are concealed by many chemical and later morphological manifestations of cell life, whatever they may be: they are ever present.

In Great Britain and Continental Europe one finds the counterpart of Professor Cowdry for this country in Professor V. Korenchevsky, head of the division of pathology at the Lister Institute, London, who now for reasons of greater safety and less disturbance carries on his work at Oxford University. He had once been a student of Metchnikoff and perhaps here was the source of the spark that flamed his interest in ageing. As a result of this interest Korenchevsky has formed not another society, but an intimate club-like international organization designated by him the "Club for Research on Ageing." He personally established in this country the American Division of this club which has functioned effectively for the past nine years. In addition to these interests in ageing the National Research Council, through the Division of Biology and Agriculture, has established a Committee on the Biological Processes of Ageing that affords another channel through which interest in ageing may express itself. This short and entirely inadequate statement in retrospect has been made to indicate the geographically wide concern which exists in connection with the ageing process and in turn to congratulate this medical school and those individuals who with wisdom made this conference possible.

The usual concept of age is that of a fixed, natural and irreversible process, chronologically determined by the species of animal which within certain fairly constant limitations terminates in death. Age and the processes constituting it should be seen and appreciated as living, fluid, elastic states of give-and-take for the sake of adjustment as an organism passes through its life span with those changes indicative of ageing being in some measure manifestations of an attempt of such an organism, man, to effect a working adaptation to these years. Certain of these signs of ageing represent failures in such an attempt. The important consideration for the student of ageing is to ascertain the reason for such failures and the cause for those states of premature ageing and instability which unrelate the individual to that environment in which he has to live and maintain a functional adjustment. Very recently Stieglitz in his volume on "Geriatric Medicine"[9] has brought to a focus the clinical application to date of information which we have in this domain.

The desire of tissues for life and relatedness is abundant.[10, 11, 12] They withstand repeated and con-

[2] Élie Metchnikoff, "The Prolongation of Life," G. P. Putnam's Sons, 1910.

[3] Charles S. Minot, "The Problem of Age, Growth and Death," G. P. Putnam's Sons, 1908.

[4] Aldred Scott Warthin, "Old Age the Major Invaluation," Paul B. Hober, Inc., 1930.

[5] Raymond Pearl, "The Biology of Death," J. B. Lippincott Company, 1922.

[6] Sir Humphry Rolleston, "Medical Aspects of Old Age," Macmillan and Company, 1932.

[7] Charles M. Child, "Senescence and Rejuvenescence," University of Chicago Press, 1915.

[8] E. V. Cowdry, "Problems of Ageing," second edition, Williams and Wilkins Company, 1942.

[9] Edward J. Stieglitz, "Geriatric Medicine," W. B. Saunders Company, 1943.

[10] Samuel Meltzer, Jr., "The Factors of Safety in Animal and Animal Economy," The Harvey Lectures, 1906-1907. J. B. Lippincott Company, 1908.

tinuous psychical and somatic insults for years before the signs of such injury develop. Even though the order of tissue change which may assert itself is of such an abnormal structure as to warrant its designation "disease," yet it may be a morphological defense mechanism to maintain life and to stabilize it at a lower level of physiological effectiveness.[13] Such changes are not infrequently seen as tissue reactions of repair to severe injury. The important and necessary understanding of ageing must come about years before such evident tissue interference develops. This information must be acquired when changes in cell life and in the individual as a whole are of a predominantly chemical order, when they are not structurally irreversible and when they afford an opportunity for chemical modification towards that normal which different animal species have established for designated age periods.

Ageing of the animal organism, of man, commences not at forty years or at some other advanced chronological period but when the male spermatozoan unites with and fertilizes the female ovum. There then commences a process of ageing with tissue differentiation and organ formation towards perfection which culminates for one period of this process at the end of the gestation period. The organism as individual at birth has so aged through constructive processes that it can now attempt to cope with a changing outside environment and by changes within itself, by processes of a physiological order, effect a functional adjustment, designated an adapted and related life. There is in such an organism no fixity of intent or purpose except to live an animal type of existence. Later with structural cerebral differentiation, the acquisition of a receptiveness on the part of such tissue, mind as learning, reason and emotion guide or fail to guide this animal body in a related fashion. The duration of the period after birth for constructive ageing towards perfection in adult life not only varies with the species of animal but with animals of the same species. In the case of man, certain families age more rapidly than others. They reach maturity more rapidly and retrogressive changes supervene at relatively earlier age periods. There is no understanding at present of the differences in the chemical constitution of the tissues of such families which determine the advent and the rapidity of the ageing process. The life span after birth furnishes a period for constructive ageing to adulthood at which time the individual shoud have reached a hypothecated normal as a balanced and related life.

During the periods of infancy, childhood and youth, life areas of a predominantly normal nature, such tissues are, in terms of their age, susceptible to accidents, designated "diseases of infancy and childhood." These transitory interruptions of this normal are usually of an infectious order and may now in many instances be specifically protected against or terminated after their development. Certain invading organisms, bacteria and viruses, appear to find tissue culture media at these age periods especially adapted, appropriately chemically constituted for their invasion and rapid multiplication. This observation at once raises the question in connection with ageing at these periods as to the chemical nature of the tissue which permits such invasions and subsequent growth of organisms. Why do we speak of poliomyelitis as infantile paralysis and thereby in terms of designation exclude on the basis of its frequency of occurrence the same specific virus disease in middle age and in senility? Such questions are rarely asked. Their solution presents an open field for research of a basic nature. An answer of a chemical order which may be found within such fixed cells that constitutes a specific affinity for the invading cells has not been approached in terms of an answer. Our attention very naturally has been focused on the organisms causing these specific diseases and on immune, protective bodies which may be produced as reactions to such tissue invasions, but we have not gone behind the appearance of these bodies to the chemical nature of cells at different age periods responsible for their production or lack of formation. The age factor, whatever that may represent in terms of chemical constitution, is the determining influence which in large measure segregates certain infectious processes.

During the age periods of infancy and childhood, over and above the accidents represented by the infectious diseases there was until some thirty or forty years ago a very high mortality in such age groups, due to imperfect feeding and disturbances of nutrition. These changes in turn certainly predisposed to the development of the specific infections. The feeding of such young tissues based on their caloric demand and the specific nutritional requirements for different chemical materials as foodstuffs was in large measure unknown. The significant influence of a general, as well as of a specific, nature of the various vitamins was unheard of. An understanding attempt could not be made to aid this young tissue in relating itself into the period of adult life. This failure was so apparent and the death rate was so high in infants and young children that a medical specialty developed, designated pediatrics. Understanding in this domain did not come about from knowledge of the adult organism. It came through the interest of in-

[11] W. B. Cannon, "The Wisdom of the Body," W. W. Norton and Company, 1932.
[12] Wm. deB. MacNider, *Annals Int. Med.*, 17: 989, 1942.
[13] Wm. deB. MacNider, *Jour. Pharm. and Exp. Therap.*, 56: 383, 1936.

vestigators in detached laboratories and later at the bedside as clinical research by individuals who were willing to concern themselves with life processes, in this instance the ageing of infants and young children, the type and amount of food materials, the fluid requirements and the vitamins necessary for such young tissues as they constructively aged. In this country Jacobi, the elder Holt and now the younger Holt, Booker, Hess and of particular significance Howland, and later his great pupil and associate, W. McKim Marriott, who made with the assistance of its present head and director, the department and clinic of pediatrics at this university. To this clinic came biological chemists, physical chemists and clinicians from throughout this country and abroad to acquire an understanding of the science of pediatrics and with such knowledge to guide and relate tissues as organisms, individuals, of the early age groups as they aged towards a hoped-for perfection. Such information came through research in segments of life that could readily respond to such applied science, a young age group, individuals with an inherent chemical urge[14] for normal development and relatedness. The same order of investigation is imperative, even though it is with more difficulty applied, for those individuals who have reached their summit of constructive development and at different chronological periods commence their descent towards senility. Here the biochemical tendency is away from the normal. The trend is not for life, it is against it. There must develop a group of scientifically trained people from and through the laboratory and into the clinic as has been accomplished by the pediatricians, who will concern themselves with an understanding of those retrogressive changes that make not their chemical, but their gross appearance at what is designated "middle age." The chemical basis for such changes must develop years before the appearance of the structural changes. Such retrogressive tissue modifications progress with periods of transitory tissue adjustment and maladjustment until the latter state becomes permanent, fixed and only stabilized as a state of disease or as physiological senility. Such states are not reversible, even though they may as such represent periods of tissue reaction in an attempt at stabilization.

In a discussion of this order it would be unfortunate to attempt to designate by age segments from adult life into senility the nature of the physical disturbances which may supervene. There does, however, in general occur in the life span of the human being a critical period of change that has so progressed chemically between the ages of forty and fifty-five that it may with fair certainty be recognized by structural changes. Concerning the chemical shifts that develop as molecular modifications in such living tissues and that culminate in the degenerative diseases we know little in terms of certainty. Of the very greatest importance is the fact that at such periods or later is the time incidence for the development of cancer. What chemical bodies assert their action at such periods which lead to cell growth of an unguided, unrestrained order? What chemical bodies cease to exert their restraining influence on tissues at such age periods which release them for a certain wildness of life, designated malignancy? The fact of cancer is intimately associated with the factor of age. Investigation in this domain is of such a specialized nature that it requires a type of investigator of highly specialized training. An understanding, however, of the critical middle-age period in man is of a more general order and primarily concerns the biochemist and the expert in nutrition. These were the individuals who were found necessary to gain an understanding of the early age periods of constructive development.

The symptoms and signs of departures from the retrogressive, the ageing normal, are of their nature both varied and variable. They are varied, depending upon which organ, organ system or tissue expresses itself in such change and their modification, their variability in such tissues, their intensity, the readiness with which they develop, is in part genetic in origin and can be influenced by thoughtful mating. In addition to the factor of heredity, there can be little doubt of the development in certain tissues, at the middle-age period, of changes in the metabolism of cells of great significance. Such states should be amenable to the use of appropriate diets aided by accurately determined inorganic and vitamin supplements. Such was the case in infancy and childhood. We know very little concerning the food requirements for older individuals, those at their critical period of change and during their advance towards senility. Biochemical and nutritional research for such age groups is not only necessary, it is imperative if we are to prevent a considerable proportion of the degenerative diseases of middle age, stabilize individuals at such periods for toil and for happiness, and which defer the advent of those years of unrelatedness designated senility.

When accidents of a major and fatal order superimpose themselves in such individuals or when by the natural extension of pathological processes life comes to an end with all its antecedent years of incapacity, the pathologist takes over and with accuracy records these changes at the autopsy table. They remain as a record of terminal events and take their place in

[14] Joseph Needham, "Biochemistry and Morphogenesis," Cambridge University Press, 1942.

a card-indexing system. Such observations are most worthwhile, but they only serve as inelastic checks on pre-existing clinical states. Such records have little significance for, and they fail to throw the light of information on, the commencement of those bodily reactions which finally culminate in such structural changes of a gross order that the pathologist can recognize them. Sir James Mackenzie, after his stay in London as the world's most illuminating and eminent cardiologist, went back to his Aberdeen to establish an institute for the study of the commencement of disease. His thought was good. It failed to come to fulfilment. He died at a relatively early age from coronary occlusion. In considering these middle-age breakdowns or the gradual progression of degenerative diseases commencing in and before this period, one fundamental type of understanding is essential. This consists in learning through research on the lower animals as well as in man the basic chemical differences in cell life as that life advances through age periods as infancy, youth and maturity to a chronological period in the life span where such chemical changes shift qualitatively, quantitatively or both, with the advent of first the symptoms and usually much later the signs, as modified structure, of commencing tissue retrogression as degeneration. Such studies are just as possible and feasible for the age periods prior to and into those of tissue degeneration which result in maladjusted individuals as they have been for the constructive age periods of tissue development and adjustment. These studies have not been made. When such segments of information are obtainable they may then be fitted together and two orders of helpfulness made available for the ageing individual—firstly, prophylactic advice and the use of natural measures for tissue protection, and secondly and with regret, attempted treatment, nutritional replacements for the existing tissue change. Repair may be difficult.

Prior to and during the Hippocratic period medical thought had to content itself with the observation and interpretation of surface, bodily phenomena. Different types of individuals were recognized and evaluations were made of their susceptibility or lack of susceptibility to disease. Finally, with the advent and establishment of such changes a prognosis was made possible concerning the outcome of the process. Later, when regulated dissection of the human body was permitted, the anatomists and their offspring, the pathologists, had an opportunity to observe gross organ and tissue changes and attempt to correlate these with the symptoms and signs of disease. Still later, with the development of the microscope these gross changes were found to be a collective reaction, in some instances similar in character, of the cell units in organs and tissues. It is at this point that pathology in general has rested its case. Such observations are essential for the morphological, the anatomical, understanding of disease. They are lifeless reactions. They are no longer a part of the elastic, adapting, living organism as individual. They afford little understanding of those pathological life processes of a chemical order which finally assume such a degree of chemical intensity as to modify cell structure and demonstrate by physical change their chemical presence. Such is the order of the commencement of disease frequently encountered in the middle-aged group of individuals. The pathology, the physiology and pharmacology of the not very distant future will be of a biochemical and biophysical order. Such a concept with the type of research which fits into it and gives understanding to it is necessary if information is to be obtained of the changing, chemical life of tissues as they advance from one age period to another, and as these periods are modified by departures from the normal. With such knowledge these changes within cells of a chemical order can to an extent be regulated and guided. The object of such regulation and tissue guidance is not to prolong life into a useless and likely unhappy senile state, but to conserve and protect it at periods in the life span where it may effectively relate itself in toil as helpfulness for the individual and the family, the economic and social order in which it lives, the industry which it serves or the profession of which it is a part.

The first essential for research is a thought. For the activation and operation of a thought as its validity is tested, financial support is essential. At the present time after man has passed the periods of infancy and childhood and has given up the guidance of the pediatrician, the rest of his life span for which the first was made is permitted to run its course without an understanding of succeeding age periods and therefore without basic guidance. The segments of life as age advances can just as certainly be understood, guided, transitorily stabilized and made increasingly effective as has been demonstrated for the earlier periods. Inquisitive individuals adequately trained with financial support for their undertakings as research will be able to prolong and relate purposefully individuals in the middle-age period of the life span, the life area which at the present time is either terminated abruptly or too frequently prepares the individual for a rapidly advancing state of premature senility. Human conservation of this order is a thrilling adventure and one which challenges the generosity of thoughtful human beings.

OBITUARY

ROBERT ANTHONY HATCHER
(1868–1944)

AMERICAN pharmacologists mourn with family and friends, and realize the great loss their science suffered when, on April 1 of this year, Robert Anthony Hatcher died in his Flushing, Long Island, home.

Dr. Hatcher retired from his Cornell professorship nine years ago, but this formal retirement did not signify either his abandonment of research or his tremendously useful and constructive work on the Council on Pharmacy and Chemistry of the American Medical Association. A tireless enthusiasm for research and a keen awareness of the problems confronting our age remained with Dr. Hatcher almost to his last day. He lived the simple, and outwardly not very spectacular, life of a typical American scientist. He was born in Missouri but spent his childhood in New Orleans. Early in youth he decided to study at the Philadelphia College of Pharmacy. Upon graduation, in 1889, he applied for his first job in a drug store and was told by the proprietor that there were already too many applicants. "Good ones?" inquired Hatcher. He got the job.

He practiced this profession for a time and was a very competent retail druggist. However, filling prescriptions did not satisfy this young Ph.G. He wanted to know more about the action of drugs, so he enrolled as a medical student at Tulane, where he obtained his M.D. degree in 1898. After a hurried trip to Europe, he secured a position in the newly organized Pharmacology Department of Sollmann at Western Reserve. His association with Sollmann was very fruitful for the science of pharmacology. It resulted not merely in scientific papers and a treatise on materia medica, but also in the formation of an intellectual bond between these two zealous advocates of pharmacology. In 1904 he was called to Cornell, where he rapidly advanced to the professorship of an independent department of pharmacology. He taught and toiled at Cornell for over three decades. His association with that institution will be felt for many years to come. During his early residency at Cornell he was also called upon to organize and give the first pharmacology courses at Harvard and Chicago.

Hatcher was not only a great teacher and missionary of pharmacology but was always in the front rank of pharmacological experimentalists. Though there are not many branches of this subject that have escaped his attention, his name will be forever associated with two fields partly created by him—the analytical pharmacology of digitalis principles and the pharmacological study of emesis. His studies on the bioassay, absorption, elimination and mechanism of action of crude and purified digitalis preparations made the rational and effective use of digitalis in heart failure possible. It was the Hatcher-Brody cat unit of digitalis leaf that made accurate, effective and safe dosage possible in the rapid and cumulative methods of digitalis administration. Every patient with congestive heart failure, receiving cardiac glucosides, owes a debt of gratitude to Dr. Hatcher.

It always astonished Hatcher how little the most common symptom of disease, emesis, attracted the attention of physiologists. Since it happens to be one of the most common effects of a large number and apparently unrelated drugs, Hatcher felt that it is the business of the pharmacologist to throw light on emesis and emetics. As a result of his labors in this field we became familiar with the complex paths of the vomiting reflex arc, with the location and the nature of the vomiting center, and with the mode of action of centrally and reflexly acting emetics.

According to the Ostwaldian terminology, Hatcher was a typical classical investigator. He was introspective, detached and attracted only a few intimate personal students and followers. Perhaps only Eggleston, Soma Weiss and Harry Gold can be considered his students in the strict sense, although many pharmacologists worked in his laboratory and were profoundly influenced by him.

As a man, Hatcher was a conservative, unalterably opposed to modern ideas of experimental statesmanship. He dreaded ochlocracy and had little use for politicos whom he suspected of trying to bring it about. And yet, he was a liberal in the best sense of the word. He made no distinction between man and man and looked for a society where merit alone would rule. Some one once asked him how it happened that there were so many immigrants from different racial groups on the staff of his laboratory. "We can't fill all positions with Indians, there aren't enough of them," was Hatcher's terse and innocent reply.

In his later years he became more and more interested in the philosophical background of science. Some of his ideas he committed to writing and they are preserved in manuscript form. He had little use for idealistic philosophy, which he held barren. The conclusions of idealistic philosophers were contradicted by common sense and daily experience in his opinion. Idealistic philosophy reminds one of a puppy chasing its tail—without the fun that the puppy has, he wrote. He agreed with Locke, however, that a rational creature reflecting on the works of creation can not miss the discovery of Deity. Speculating on the nature of mind and intelligence, Hatcher came to the conclusion "that these reached

their highest development in God—who is infinite. God is the only one who has an absolute freedom of will and God's will has a greater velocity of motion than that of light, thus he rules the universe." He contended that only absolute knowledge can mean absolute happiness, and this ideal can only be obtained by God. Man can only approach that ideal, but he can know, if intelligent, that he can contribute something to the ultimate attainment of that ideal by others, by leading the life that wisdom dictates, Hatcher reasoned. At least he must convince himself that he can enjoy the happiness of knowing that he is striving toward the right goal and happiness is achieved in conscientious effort nearly as well, whether successful or unsuccessful. Happiness for the individual man is impossible before he has learned that the greatest good for the greatest number or the greatest truth is superior to his personal happiness, he concluded.

The great pharmacologist has passed into eternity. He advanced knowledge, he alleviated suffering, he worked hard to prevent hostile hands from uprooting pharmacology, that young tender branch of medical science. Belief in the independence of human dignity, in the independence of pharmacology, are the precious heritages of this pioneer of American pharmacology.

THEODORE KOPPANYI
GEORGETOWN UNIVERSITY

DEATHS AND MEMORIALS

DR. WILLIAM SPENCER CARTER, physiologist, dean of the medical faculty, retired, of the University of Texas, died on May 12 at the age of seventy-five years.

PROFESSOR OSCAR M. STEWART, from 1905 until he retired with the title emeritus in 1940 professor of physics at the University of Missouri, died on May 17 in his seventy-fifth year. He was connected with the university for forty-four years.

DR. LESTER S. GUSS, head of the department of chemistry at South Dakota State College at Brookings, president of the South Dakota Academy of Science, died on May 17 in his fortieth year.

CHARLES STEWART BECKWITH, chief of cranberry and blueberry investigations at the College of Agriculture of Rutgers University, died on May 18 at the age of fifty-three years.

THEODORE WILLARD CASE, the physicist, president of the Case Research Laboratory at Auburn, N. Y., died on May 13 in his fifty-fifth year.

JAMES WALLACE BEARDSLEY, consulting civil engineer, retired, who was from 1905 to 1908 director of public works in the Philippines, died on May 15 at the age of eighty-three years.

THE death on October 12, 1943, at the age of sixty-eight years, is announced of Maulsby Willett Blackman, senior entomologist in the division of insect identifications of the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture.

THE hundredth anniversary of the first telegraph message between Washington and Baltimore on May 24, 1844, was celebrated throughout the United States during the week beginning on May 22. At New York University brief ceremonies were held on the site where Professor Samuel Finley Breese Morse demonstrated his invention of the electromagnetic telegraph to a few friends in 1838 before taking it to Washington to interest the Congress. Miss Leila Livingston Morse, granddaughter of Professor Morse, unveiled a temporary tablet (to be replaced when bronze again becomes available) in the Samuel Finley Breese Morse Study Hall on the site where the first instrument was built and demonstrated. Morse memorabilia, including a working model of the original instrument, were exhibited.

SCIENTIFIC EVENTS

THE NATIONAL CHEMICAL EXPOSITION

THE Chicago Section of the American Chemical Society reports that the third National Chemical Exposition, to be held from November 15 to 19 at the Coliseum in Chicago, will not only demonstrate the importance of the chemical industry for the war effort but also for the post-war era. M. H. Arveson is chairman of the committee that is making arrangements for the exposition. The South Annex of the Coliseum has been leased and it is hoped also to acquire the North Hall, but despite the fact that more than twice the area of the two preceding expositions has been made available for exhibitors, there is indication that it may not be possible to provide space for all applicants.

The first exposition held in 1940 at the Stevens Hotel occupied over twenty-six thousand square feet of floor space, and the second in 1942, held at the Sherman Hotel, provided more than thirty-two thousand square feet. Floor space of the coming exposition will exceed fifty-six thousand square feet.

The National Industrial Chemical Conference will meet during the exhibit when authorities on virtually all phases of pure and applied chemistry will appear on the program which is now being arranged by the conference committee. The sessions will be held in the conference hall on the second floor of the South Annex.

Presentation of the Willard Gibbs Medal, founded in 1911 by William A. Converse, will be made during

the meeting. The medal is bestowed each year "in recognition of eminent work in and original contributions to pure or applied chemistry." As reported in SCIENCE last week, it has been awarded this year to Dr. George Oliver Curme, Jr., vice-president and director of research of the Carbide and Carbon Chemicals Corporation of New York City.

THE KENTUCKY ACADEMY OF SCIENCE

THE thirty-first annual meeting of the Kentucky Academy of Science was held at the University of Kentucky, Lexington, on April 28 and 29. The divisions participating were biology, bacteriology, chemistry, geology, mathematics and psychology. Thirty-six papers were read at the meetings, which were well attended.

At a symposium on Post-War Planning for Science and Scientific Personnel, the speakers were:

Dr. D. B. Keyes, Office of Production Research and Development, W.P.B., Washington, D. C.

Lieutenant Colonel John D. Kenderdine, Morale Division, A.S.F., Washington, D. C.

H. C. Blankmeyer, Jos. E. Seagram and Sons, Louisville.

Henry T. Heald, president of the Illinois Institute of Technology, Chicago, Ill.

Officers of the academy elected for 1944–45 are:

President, Paul J. Kolachov, Jos. E. Seagram and Sons, Louisville.

Vice-president, Ward C. Sumpter, Western Kentucky State Teachers College, Bowling Green.

Secretary, Alfred Brauer, University of Kentucky, Lexington.

Treasurer, Wm. J. Moore, Eastern Kentucky State Teachers College, Richmond.

Representative on the Council of the American Association for the Advancement of Science, A. R. Middleton, Louisville.

Councilor to Junior Academy, Anna A. Schnieb, Richmond.

THE VIRGINIA ACADEMY OF SCIENCE

AT the meeting on May 9 and 10 in Richmond of the Virginia Academy of Science, H. R. Hanmer, director of research for the American Tobacco Company, was elected the twenty-third president of the academy. This is the first time an industrialist has been named head of this organization. Dr. E. C. L. Miller, directing librarian at the Medical College of Virginia, and Dr. Sidney S. Negus, professor of chemistry at the same institution, were reelected secretary-treasurer and assistant secretary, respectively. Dr. Robert F. Smart, professor of biology at the University of Richmond and chairman of the Division of Sciences, was installed as president for the coming year.

A paper on the "Graphical Determination of Complex Roots of the Quadratic" by Clifton B. Cosby, of the United States Patent Office, Richmond, won the Jefferson Prize of $50 for "a meritorious paper presented at the meeting."

Dr. J. Herbert Taylor, a former research fellow of the Blandy Experimental Farm of the University of Virginia, was awarded the Academy Prize, also $50, for his paper on "Cyto-taxonomy and Phylogeny of the Oleaceae, Lindl."

There were three hundred and fifty-four in attendance and one hundred and fifteen papers presented.

THE VAUGHAN RESEARCH AWARDS IN HORTICULTURE

THE American Society for Horticultural Science has established two awards of $500 each for the best papers presented before the society. This was made possible through a gift made by L. H. Vaughan, of Vaughan's Seed Stores, Chicago. One of these awards will be made in the field of floriculture and one in vegetable crops. It is expected that they will be continued for at least three years. The following regulations have been adopted:

1. The winning papers must be presented by members of the society to the annual meeting or any one of the recognized sectional meetings and published in the *Proceedings.* Papers by two or more authors will be considered as units. Presentation need not be in person.

2. One award of $500 will be made for a paper reporting research in floriculture and one of $500 for one in vegetable crops, provided that if no worthy paper in one of these fields is presented, one of the awards may be made in some other field of horticulture. If no worthy paper appears, no award will be made.

3. Preference will be given to papers that present new discoveries in these fields, showing promise of commercial importance or practical applications.

4. All papers presented during a space of one year following December 1 of each year will be considered for the awards of that year. The winners will be announced at the annual meeting in the following year. (Awards were made at the 1942 meeting for two papers that had been presented and published in the *Proceedings* between December 1, 1941, and November 30, 1943).

5. In making the awards, due consideration will be given to the age, experience and record in research work of the authors. Preference will be given to papers by authors under thirty-five years of age.

6. Judging the papers will be on the basis of (1) originality, (2) soundness, (3) accuracy, (4) clearness and conciseness of presentation and (5) value of the work, especially in its practical applications.

7. These regulations and the committee procedure following are to be considered tentative. They will be adhered to, if possible, for this year.

The award in horticulture in the field of vegetable crops for 1943 has been made to Dr. Henry A. Jones and Dr. Alfred E. Clark, of the U. S. Department of Agriculture, Beltsville, Md., for their paper entitled "Inheritance of Male Sterility in the Onion and the Production of Hybrid Seed," and in the field of floriculture to Dr. L. F. Randolph and Dr. Leland G. Cox, of Cornell University, for their paper entitled "Factors Influencing the Germination of Iris Seed and the Relation of Inhibiting Substances to Embryo Dormancy."

THE NORTH AMERICAN ARCTIC

THE war has focussed attention anew upon North America's last frontier—the Far North. It is inevitable that this attention will grow into deep interest in the post-war years. The development of the areas involved should be based upon careful planning, which in turn demands as a background the best and broadest scientific study that can be brought to bear on the Arctic regions.

A meeting was held in New York City on May 13 to consider the feasibility of establishing a regional North American Arctic Institute with scientific objectives in view. The following men were present:

Major Patrick D. Baird, Ottawa, Canada.
Dr. E. Gordon Bill, Hanover, N. H.
Dr. R. W. Boyle, Ottawa, Canada.
Dr. Charles Camsell, Ottawa, Canada.
Lt. Colonel William S. Carlson, New York, N. Y.
Major Richard F. Flint, New York, N. Y.
Dr. L. M. Gould, New York, N. Y.
A. D. P. Heeney, Ottawa, Canada.
Dr. Diamond Jenness, Ottawa, Canada.
W. L. G. Joerg, Washington, D. C.
Dr. Hugh Keenleyside, Ottawa, Canada.
Dr. Trevor Lloyd, Hanover, N. H.
G. R. Parkin, Montreal, Canada.
Erling Porsild, Ottawa, Canada.
Walter Rogers, New York, N. Y.
Dr. V. Stefansson, New York, N. Y.
Lt. A. L. Washburn, New York, N. Y.
Colonel J. T. Wilson, Ottawa, Canada.
Dr. John K. Wright, New York, N. Y.
Dr. V. C. Wynne-Edwards, Montreal, Canada.

Further consideration of the ideas and suggestions made at the meeting will be given by a small continuing committee. Communications should be addressed to L. M. Gould, 446 East 66th Street, Apt. 2-J, New York 21, New York.

SCIENTIFIC NOTES AND NEWS

THE Sociedad Mexicana de Historia Natural at a meeting held in Mexico City on May 12 conferred honorary membership on Dr. Richard B. Goldschmidt, professor of zoology at the University of California at Berkeley. Dr. Goldschmidt made an address on "Genes and Chromosomes."

THE Ohio State University will confer at its commencement in June the doctorate of science on Thomas Midgley, Jr., vice-president of the Ethyl Gasoline Corporation, president of the American Chemical Society, and on Dr. Arno Carl Fieldner, chief of the Fuels and Explosives Service of the U. S. Bureau of Mines.

RUSSELL SAGE COLLEGE at its twenty-seventh commencement exercises on May 14 conferred the doctorate of science on Dr. Katharine B. Blodgett, research physicist of the General Electric Company.

THE degree of doctor of science was conferred at the sixty-sixth annual commencement of Smith College on Sophie Satina, research associate in cytogenetics in the department of botany.

THE Howard Taylor Ricketts Prize of the University of Chicago has been awarded to Dr. Paul Everett Thompson, of the university, in recognition of "outstanding research on malaria."

THE Bessemer Gold Medal for 1944 of the British Iron and Steel Institute has been awarded to Essington Lewis, director-general of munitions and of aircraft production for Australia, "in recognition of his outstanding services to the iron and steel industry of Australia."

DR. WARFIELD T. LONGCOPE, professor of medicine in the School of Medicine of the Johns Hopkins University, was elected at the Atlantic City meeting president of the Association of American Physicians.

GEORGE F. BATEMAN, dean of the Schools of Engineering of Cooper Union, has been elected president of the New York Electrical Society; Dr. Colin G. Fink, professor of electrochemistry at Columbia University, first vice-president, and Dr. Ernst Weber, research professor in electrical engineering at the Polytechnic Institute of Brooklyn, second vice-president.

DR. CHARLES R. DOWNS, consulting chemical engineer, has been elected president of The Chemists Club, New York City. He succeeds Carl Raymond DeLong.

DR. SANFORD S. ATWOOD, who has been associated with the U. S. Regional Pasture Research Laboratory at the Pennsylvania State College since 1937, has become assistant professor in the department of plant

breeding of Cornell University, where he will conduct cytogenetic and breeding investigations with forage crops. Dr. Atwood took up the work on May 1.

DR. MARION MURPHY BROOKE, associate in parasitology at the School of Hygiene and Public Health of the Johns Hopkins University, has been appointed associate professor of preventive medicine at the School of Medicine at Memphis of the University of Tennessee.

WALTER FITZGERALD, senior lecturer of the University of Manchester, England, has been appointed professor of geography to succeed Professor H. J. Fleure, who retires in September.

DR. ROBERT C. MILLER, director of the California Academy of Science, Golden Gate Park, Calif., has been elected secretary of the Pacific Division of the American Association for the Advancement of Science in succession to Dr. J. Murray Luck, professor of biochemistry at Stanford University, who has resigned as of June 30. After July 1 all communications pertaining to the Pacific Division should be directed to Dr. Miller at the above address.

FOLLOWING the recent reorganization of the various departments of the Library of Congress, Frederick E. Brasch, formerly chief of the Smithsonian Division, has been advanced and now assumes the title of consultant in the history of science.

DR. MARSTON TAYLOR BOGERT, professor emeritus of organic chemistry at Columbia University, was reelected president of the Supervisory Board of the American Year Book at its annual meeting in New York on May 16. This board is composed of representatives of forty-six national learned societies, which cooperate in the editing of this annual record of events and progress.

DR. GEORGE H. YOUNG has been appointed executive assistant of the Mellon Institute of Industrial Research, Pittsburgh. He has been associated with the institute since 1935, first as industrial fellow, then as senior fellow, on the Stoner-Mudge, Inc., Multiple Industrial Fellowship on Protective Coatings. He will take up the management of the research programs of the institute on June 1. During the past three years he has been occupied almost exclusively with problems closely connected with the war effort.

DR. HENRY C. SHERMAN, chief of the Bureau of Human Nutrition and Home Economics of the U. S. Department of Agriculture, has resigned effective in June and will return to his professorship at Columbia University. He will be succeeded at the bureau by Dr. Hazel K. Stiebeling, now assistant chief.

DR. HARVEY N. DAVIS, director of the Office of Production Research and Development of the War Production Board since 1942, has submitted his resignation to take effect on June 1, when he expects to return to his work as president of the Stevens Institute of Technology.

THE *Journal* of the American Medical Association reports that Major General Norman T. Kirk, Surgeon General of the Army, has appointed five science writers as civilian consultants. The men, who are also members of a subcommittee of the Division of Medical Sciences of the National Research Council and members of the National Association of Science Writers, are David Dietz, science editor, Scripps-Howard Newspapers, Cleveland; James C. Leary, science editor, Chicago *Daily News;* Robert D. Potter, science editor, *American Weekly,* New York; Lawrence C. Salter, associate director of press relations, American Medical Association, Chicago, and William L. Laurence, science news editor, *The New York Times.* These writers will work with the Surgeon General and his staff in the preparation of information for the public on new developments in medical research in the Army.

PROFESSOR L. W. BUTLER, of the department of physics of the Iowa State College, has leave of absence to enable him to take up research on naval equipment at the Naval Ordnance Laboratory in Washington.

R. J. KOWAL, of the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, has been assigned to Barro Colorado Island in the Canal Zone to make a series of tests relative to the injection of chemicals into the sap stream of living trees to determine the effectiveness of this method to protect tropical wood from termites.

WILLIAM C. COOPER, of the Office of Foreign Agricultural Relations, is visiting the Cooperative Experiment Station at Tingo María, Peru. While there he will conduct agronomic studies in connection with the complementary-crops program.

SEÑOR EMILIO PINEL, professor of physics at the University of Honduras and professor of agriculture at the Tegucigalpa High School, recently arrived in the United States as the guest of the Institute of Inter-American Affairs to study the organization of field centers of the U. S. Department of Agriculture. Señor Pinel was recently appointed director of agriculture of the Republic of Honduras.

DR. LOYAL DAVIS, professor of surgery at the Medical School in Chicago of Northwestern University, gave the annual Walter L. Niles Memorial Lecture at Cornell University Medical College on May 18. He spoke on "Experiences as Consultant in Neurological Surgery in the European Theater of Operations."

DR. T. M. SONNEBORN, of the department of zoology of Indiana University, spoke on April 27 before the Science Club of Vanderbilt University on "The Structure of the Gene and the Nature of Gene Action in Relation to Work on Paramecium."

DR. HUGH STANNUS delivered on April 18 and 20 the Lumleian lectures of the Royal College of Physicians, London. He discussed problems in riboflavin and allied deficiencies.

THE twenty-fifth annual meetings of the American Geophysical Union and of its eight sections will be held in the Hall of Government, George Washington University, Washington, D. C., on June 1 and 2, and on June 3 a joint meeting with the Section of Seismology and the Eastern Section of the Seismological Society of America.

THE *Journal* of the American Dental Association announces that, as a result of new regulations of the War Department, dental schools throughout the country will suffer a fifty per cent. reduction in the Army quota of students scheduled to enter next year.

IT is reported that Kemper K. Knapp, a lawyer of Chicago, who died on February 23, bequeathed "in excess of $1,000,000" to the University of Wisconsin. He indicated a wish that part of the fund be used for scholarships in the undergraduate or law departments for graduates of Illinois and Wisconsin high schools.

ACCORDING to the will of the late Dr. Charles W. Burr, professor emeritus of mental diseases of the School of Medicine of the University of Pennsylvania, the sum of $200,000 is bequeathed to the endowment fund of the university. His library of about 19,000 volumes is also left to the university.

THE *Journal* of the American Medical Association reports that fellowships in graduate health education leading to a master of science degree in public health are being offered by the U. S. Public Health Service through funds made available by the W. K. Kellogg Foundation. The training provides nine months in academic work in public health and public health education and three months of supervised field experience. A stipend of $100 per month is provided for twelve months, free tuition and travel for field experience. Candidates must pay their traveling expenses to and from the university at the beginning and end of training. Fellowships, which will be available for the fall quarter of 1944, are extended at this time only to qualified American women between the ages of nineteen and forty. Men can not be considered because of the demand for manpower for military service. Qualifications should include a bachelor of science degree or its equivalent from a recognized college or university. Additional information may be obtained from the Office of the Surgeon General, U. S. Public Health Service, Washington 14, D. C. Applications must be accompanied by a transcript of college credits and a small photograph, and must be received not later than August 1.

THROUGH the development of a new American War Standard-Coordination of Graphical Symbols for electrical and electronic equipment, a consistent set of symbols has been issued by the American Standards Association. Previously one symbol was sometimes used to indicate two different pieces of apparatus, and in some cases two different symbols meant the same thing. This standard, in the development of which many national groups and representatives of the Armed Forces cooperated, is admittedly a compromise.

AT the Scientific Exhibit to be held at the Palmer House in connection with the meeting in Chicago of the American Medical Association, emphasis will be placed on war medicine with exhibits from the Army and the Navy. Special exhibits include fractures, the treatment of burns, chemotherapy, infectious diseases and rehabilitation. There will also be a group of exhibits on tropical medicine, and lectures and conferences on rheumatic fever and heart disease.

THE *Journal* of the American Medical Association reports that a cancer control foundation has been established in Ontario. A legislative appropriation of $500,000 will assist in its support. The foundation has been empowered to acquire lands and buildings and to employ a director, officers and the necessary clerical staff. Lieutenant Colonel A. L. Bishop, Toronto, is chairman of the foundation. Other members include Arthur Ford, London; Dr. George S. Young, Toronto; Malcolm Cochrane, Port Arthur; Robert Brown, Toronto; R. E. Stratford, Sarnia, and Kenneth Emerson Deacon, Unionville.

A WHITE paper issued by the British Government on April 6, as reported in *The Times*, London, gives an account of the Government organizations which are concerned with research and development related to the problems of industry. For fundamental research and for the education of research workers, responsibility largely rests with the universities. For these purposes assistance is given by the government. There are now in existence in Great Britain more than twenty agricultural research institutes and stations covering a wide variety of subjects. Most are not owned or managed directly by the State; some are attached to the universities, and others are owned by associations representing branches of the agricultural and horticultural industries. The Minister of Agriculture and the Secretary of State for Scotland have recently set up new machinery designed to ensure

that the results of research are applied as rapidly as possible in farming. The agricultural improvement councils appointed by these ministers will keep in close touch with experiments in new farming methods and will advise, after testing, on their introduction into ordinary farming practice.

DISCUSSION

INTERPENETRATING CLIMAXES IN QUEBEC

AN accurate mapping of the climax areas of vegetation is possible to date only in the North Central States. Phytosociological work in New England, Quebec, Ontario and the Maritime Provinces is still fragmentary. The general limits of the Canadian forest (*piceetum*), of the lake forest (*tsugetum*) and of the oak-hickory forest (*quercetum*) are fairly well known. But their ultimate reaches in the Northeast have not been thoroughly investigated.

Recent exploration has revealed that the sugar maple community extends quite to the tip of the Gaspé Peninsula. It is absent from the immediate coastline all the way from Saint-Jean-Port-Joli, but occupies the hinterland in a more or less continuous strip on the foothills. It is true that beech (*Fagus grandifolia*) drops out at the beginning of the peninsula, but these maple woods are otherwise typical, with *Acer saccharophorum, Betula lutea, Acer pennsylvanicum, Cornus alternifolia, Dicentra Cucullaria,* etc. It is also noteworthy that, when tapped, they seem to yield an average quantity of sugar.

This poses the question of interpretation of interpenetrating climaxes. Potzger and Friesner[1] have shown that, in Indiana, conditions can be such that the more "favorable" sites will be occupied by the mesophytic *aceretum,* and the less favorable but topographically mature will be colonized by the *quercetum.* It may be that such circumstances prevail in the Gaspé in reference to the *aceretum,* occupying the sheltered, well-drained foothills, whilst the more hygric *piceetum* dominates elsewhere.

Again, north of Lake Saint-Jean, the same relationship obtains between the boreal forest and the taiga or hudsonian zone. The new road built by the Aluminum Company of Canada to its barrage at Passes Dangereuses (latitude 50° N) offers a good cross-section through virgin forest. At about latitude 49°, one can witness the contact of three climaxes: (1) immense stretches of very typical Canadian forest; (2) isolated stands of taiga; (3) restricted stands of deciduous forest. The last true maple grove occurs at Metabetchouan, on the shores of Lake Saint-Jean itself. Gradually the typical elements fall out: *Acer saccharophorum* a few miles north of the lake, *Acer rubrum* 20 miles, and finally *Betula lutea* 38 miles. The last named, with hardly any admixture of fir (*Abies balsamea*), forms pure stands at the aforementioned point of contact.

Just what climatic interpretations are warranted by the distribution of these phytosociological groups in the Province of Quebec? There is some evidence that our climate is getting colder and moister (Cooper,[2] Sears[3]), at least in the east (Griggs,[4] Raup[5]). The distribution just outlined is certainly consistent with that theory. Also the existence in the Gaspé Peninsula of a few isolated and evidently relict colonies of red oak (*Quercus borealis*[6]) seems to indicate formerly warmer and drier conditions. It is not unlikely that species of wide midland distribution, such as *Hamamelis virginiana, Celtis occidentalis, Andropogon furcatus, Sorghastrum nutans, Camptosorus rhizophyllus* and others apparently introduced through the Ottawa Valley, are equivalent in Quebec to prairie relicts in Ohio and Indiana[7] and owe their extension to a former period of reduced precipitation. There is evidence also that the "lake forest" reached much further to the north and east, since *Tsuga canadensis* once occurred at Matamek,[8] several hundred miles beyond its present distribution.

Interpenetrating climaxes therefore may be indicative of former conditions and their moving borderlines are likely to follow the fluctuations of climatic trends. The relative vitality within a given area and on comparable topography and soil of the elements respectively characteristic of each climax is an indication of the immediate trend of the locality. It has been shown, in Alaska,[9] for instance, that local factors can be active in a sense (warming or cooling) opposite to the general trend.[10]

Many factors, therefore, must be taken into consideration to correctly interpret the present pattern of vegetational types in Quebec. The first is cohesion of the climax complex. Of course, the climax association, for instance, *Aceretum saccharophori,* on the edge of its range in Gaspé and Lake Saint-Jean, tends to disintegrate. It can still be said to represent the climax association, however, as long as it is not conspicuously invaded by the elements of the neighboring

[1] J. E. Potzger and R. C. Friesner, *Butler Univ. Bot. Stud.,* 4: 181–185, 1940.

[2] W. S. Cooper, *Jour. Geol.,* 50: 981–994, 1942.
[3] P. B. Sears, *Bot. Rev.,* 8: 708–736, 1942.
[4] R. F. Griggs, SCIENCE, 95: 515–519, 1942.
[5] H. M. Raup, *Jour. Arn. Arb.,* 18: 79–117, 1937.
[6] E. Campagna, *Ann. de l'Acfas,* 5: 104, 1939.
[7] N. E. Transeau, *Ecology,* 16: 423–437, 1935.
[8] Paul W. Bowman, *Ecology,* 12: 694–708, 1931.
[9] R. F. Griggs, *Ecology,* 15: 80–96, 1934.
[10] W. S. Cooper, *Ecol. Monogr.,* 12: 1–22, 1942.

climax, the *piceetum*. In other words, it is true *aceretum* if the climax elements are still dominant, in number of species and in abundance of individuals. This seems to be the case for the Gaspé stands of deciduous forest.

Second is vitality. Do these aforementioned elements tend to complete their cycle and development? With as great relative success as in the optimal area? Again this is so in the Gaspé *aceretum*.

A third factor, of more delicate interpretation, owing to the lack of available data, is the possible position of climax associations as pre-climax or post-climax outside their optimum range, as suggested by Cain[11] and Potzger and Friesner[12] in relation to *quercetum* and *aceretum* in Indiana. It is not unlikely that in Quebec stands of "lake forest," for instance, on the sandy soils at the mouth of the Richelieu, are pre-climax to the maple grove or possibly even subclimax. It may be that deciduous forest in Gaspé is pre-climax to the more generalized spruce-fir (*piceetum*). The southernmost islands of taiga mentioned above might also be considered as post-climax, since they are—under a scarcely modified form—subclimax farther south, in the hydrosere.

Surely the southern edge of the laurentian shield presents a fairly complex vegetational pattern. It has most often been considered an "ecotone." However, to one who is familiar with that pattern, it appears much more as a mosaic of associations than of species. What is meant here is that, for instance, the deciduous forest and the Canadian forest on their points of contact may interfinger over fairly large areas, but in any given stand, each community remains distinct: the species themselves do not ordinarily mingle. That is also true, although to a lesser degree, of the later seral stages. For instance, white pine and hemlock seldom if ever occur on the climax site of spruce-fir forest, as they are subclimax to the deciduous forest.

In any case, it seems doubtful here if the designations pre-climax and post-climax will serve any useful purpose if two climaxes interpenetrate over an area several hundred miles wide. It may be better to recognize the permanence of two separate climaxes over a varied topography that allows, however, of no physiographic evolution rapid enough to overcome climatic change itself.

PIERRE DANSEREAU

SERVICE DE BIOGÉOGRAPHIE,
UNIVERSITÉ DE MONTRÉAL

THE GENERIC NAME OF THE SAND FLY

IN his statement published in SCIENCE for April 28, 1944, your correspondent, W. F. Rapp, Jr., has completely overlooked the reason for the emended spelling, *Phlebotomus*, commonly applied to the sand flies, otherwise known as *Flebotomus*. All codes of nomenclature provide, of course, that the spelling of every generic name be that used by the author in his original publication where the name was first proposed. Specific exception is made, however, where it is evident that the original spelling includes a typographical error and permission is given to correct such mistakes in later publications.

Rondani used *Flebotomus* in designating the genus in 1840, but the derivation of the name is so obvious (from φλερός, vein and τομή, cutting) that Agassiz and most later zoologists have emended the spelling to *Phlebotomus*, using the corrected Latinized form. Thus, the change has been made to correct a very evident typographical error, and not for reasons unknown, nor "to make it easier to pronounce," as suggested by Dr. Rapp. A further reason to invoke the provision of the code concerning the correction of typographical errors lies in the common and long-standing use of the combining form *phlebo-* in a series of common medical terms referring to veins, blood, blood-letting, etc. Also the term phlebotomic or its close counterpart is regularly applied to the blood-sucking insects in English and in the other more widely used European languages.

CHARLES T. BRUES

BIOLOGICAL LABORATORIES,
HARVARD UNIVERSITY

ISOLATION OF ERGOSTEROL FROM PENICILLIUM NOTATUM

DURING the course of the determination of the hydrocarbon content of plants as part of work on the origin of petroleum,[1] we have studied *Penicillium notatum*, grown for the production of penicillin. The non-saponifiable matter from a butanol extract of the wet mycelium produced an easily purified sterol which has the distinctive properties of ergosterol; m.p. 160–162°, $[\alpha]^{25}_D$ −126[2a]. Acetate, m.p. 171–174°, $[\alpha]^{25}_D$ −90[2b]. Benzoate, m.p. 165–167°, $[\alpha]^{25}_D$ −64[2c]. The amount of ergosterol isolated approximated 1 per cent. of the dry weight of the mycelium, although maximum recovery was not attempted. Ergosterol has been isolated from yeast, ergot and a variety of fungi. It will be recalled that the irradiation of ergosterol yields vitamin D_2, calciferol.

We wish to thank the Department of Bacteriology of the School of Agriculture and the War Production Board Penicillin Project for the material studied.

[11] S. A. Cain, *Am. Midl. Nat.*, 21: 146–181, 1939.
[12] Potzger and Friesner, *l.c.*

[1] American Petroleum Institute Research Project 43b.
[2] (a) Purified hydrated ergosterol melts at 160–163°, $[\alpha]^{20}_D$ −128.7, Callow, *Biochem. Jour.*, 25: 79, 1931. (b) Acetate, m.p. 179–180°, $[\alpha]^{25}_D$ −90, Bills and Honeywell, *Jour. Biol. Chem.*, 80: 15, 1928. (c) Benzoate, m.p. 168–170°, $[\alpha]^{23}_D$ −70.5, Wieland and Asano, *Ann.*, 473: 300, 1929.

Our thanks are due to our former colleague, Russell E. Marker, now in Mexico, for the methods used.

H. D. ZOOK
T. S. OAKWOOD
F. C. WHITMORE

SCHOOL OF CHEMISTRY AND PHYSICS,
THE PENNSYLVANIA STATE COLLEGE

UNUSUAL MORTALITY AMONG GEOLOGISTS

DURING the slightly over five months ending April 19 no less than sixteen fellows of the Geological Society of America have died. Only twice in the entire fifty years of the society's history has the entire annual loss of its personnel been as heavy as in this five-month period. Never has the distinction of the deceased fellows been so outstanding. The list follows:

	Date of death		Age
	1943		
Frank Leverett	November	15	84
H. L. Fairchild	"	29	94
	1944		
G. O. Smith	January	10	73
E. B. Mathews	February	4	74
Arthur Keith	"	7	79
F. G. Clapp	"	18	65
E. O. Ulrich	"	22	86
Douglas Johnson	"	24	66
R. E. Dickerson	"	24	66
J. A. Taff	March	8	81
H. A. Buehler	"	14	68
B. L. Miller	"	23	69
H. L. Smyth	April	3	81
H. N. Eaton	"	12	64
F. C. Schrader	"	16	83
R. C. Wells	"	19	66
	Average		74.5

This list includes our foremost glacial geologist (Leverett); three former presidents of the Geological Society of America (Fairchild, Keith and Johnson); a former director of the U. S. Geological Survey (Smith); a Penrose Medallist (Ulrich); four members of the National Academy of Sciences (Leverett, Keith, Ulrich and Johnson) and two of the American Philosophical Society (Leverett and Johnson).

Three other geologists not fellows of the society died within the same period. They were George Steiger, who died on April 18 at the age of 74, R. C. Wells, who died on April 19 at the age of 66, and F. B. Hanley, who died on April 24 at the age of 45.

Can these losses, notwithstanding the ripe age of the men, be regarded as war casualties? Some we know have been called back into strenuous active service, and all have probably suffered disillusionment by reason of the world catastrophe with its destruction of cultural institutions and values, to which their lives have been devoted. Few have been without close friends or relatives in supreme danger on the fighting fronts.

WM. H. HOBBS

THE PAPER SHORTAGE AND SCIENTIFIC PUBLICATION

WARTIME limitations of paper are making serious difficulties for our scientific periodicals, and the paper shortage is more likely to increase than to diminish.

Three adjustments are possible: (1) Scientific journals might be officially recognized as of greater value than, say, newspapers, and so obtain higher priorities; (2) there could be a drastic curtailment of publication; (3) better printing, editing and other means could secure publication of substantially the present material in less space.

Doubtless scientific publications are more valuable than much of the stuff that is printed in the popular newspapers and magazines. But it is altogether unlikely that scientific journals could compete with popular magazines in bringing pressure on allocating authorities.

Drastic curtailment in the publication of scientific results would be a calamity to the nation. As a matter of fact, the paper shortage merely brings to a head a crisis in scientific publication which has been long developing, and it is high time that it be given careful consideration. The effectiveness of scientific investigation is menaced by increasing difficulty and delay in publication. Prior to this present squeeze in paper the chief difficulty has been due to rising costs which compelled restriction of output with consequent congestion until papers often become almost obsolete before publication. Nothing is more important to the advance of science than the prompt interchange of results. This has been accomplished by printing, but present conditions have fostered other and quicker modes of diffusion. These should be stepped up in frequency and in effectiveness.

The easiest method for prompt dissemination of results is by the exchange of manuscripts within the small circle of workers known to be actively concerned. This gives insiders a great advantage. During the war when much is secret, outsiders have little chance of making useful contributions. No one doubts the necessity for secrecy in war research, but science advances mostly through the stimulation of mind on mind. The chief function of technical societies is to keep their members abreast of progress, and desire to keep up with developments is the principal motive for maintaining membership. In elementary self-interest, therefore, a technical society ought to be alert for every means of increasing its usefulness to its members.

Some societies distribute advance abstracts of the papers offered at their annual meetings. Not infrequently these appear more than a year before the papers themselves are printed. Authors and program makers should take great pains to improve abstracts.

Many of those published at present leave much to be desired. Often a list of procedures rather than a summary of results and conclusions is offered. But there is no reason for restricting advance abstracts to papers which are to be read at meetings. This is especially true in these days when meetings are curtailed. Why not publish an abstract of every paper as soon as it is received?

Microfilm or other copies of manuscripts awaiting publication could readily be made available immediately upon receipt of a paper. Much could be done by building up notification services linked with advance abstracts so that interested people would be apprised promptly of completed researches. If editors would publish "Advance Abstracts of Papers Received and Available in Microfilm" in every issue of their journals, I venture to predict that readers would habitually turn to this section of the journal before reading anything else.

Abstracts should be published immediately upon receipt of a paper, before decision was reached whether or not to print it (except for papers obviously unsuitable for the journal concerned). Whatever the editor may think of a paper, the writer is ready to have it broadcast, and immediate distribution would be highly desirable to both author and editor—in more ways than one. The circulation of copies privately would promote discussion and criticism which would greatly lighten editorial work, providing what would amount to a wider circle of referees than are now consulted. More extended criticism would cause authors to revamp and improve their papers, and the journals would benefit greatly.

Wide prepublication circulation of results would permit editors to view their tasks from a point of view entirely different from that which they must now take. One often hears it said of some of the most valuable scientific papers that they will be used by only a dozen men anyway and the opinion of the rest doesn't matter. If, now, the dozen people who would actually use the paper had already read it, there would be less need of publishing it in full. Under these circumstances the editor's job would be to publish such a condensation of the manuscript as would be useful or interesting to the majority of his readers. Copies of the original would still be available to all who need the details, and could be cited like published papers.

A concrete illustration of the service that advance abstracts could render to science will be useful: There has been discussion between British and Americans as to the proper daily allowances of certain vitamins. The British, perhaps unduly influenced by short supplies, have felt that their people could get along on one third of the American allowances. Some Americans have been fearful of the consequences to the English people. Decisions on both sides had been reached on the basis of inference from indirect evidence. In reviewing the situation a consultant alluded to a paper, referred to him by an editor, which gave the results of an experiment on human beings and fixed the needed level of intake. The authors promptly supplied a copy, and their researches began immediately to bear fruit.

Two months later a casual telephone conversation revealed the fact that the Office of the Quartermaster General was worrying about the same problem. They had not heard of the research, which was still unpublished. Again, because of knowledge possessed only accidentally, and only accidentally transmitted, the application of science was speeded up.

Four months later the paper was published, considerably recast and improved. This improvement was an important gain to both author and journal. But immediate use of the results was important. An advance abstract, making everybody aware of what was going on, would have saved at least three months time in an important war service.

Many times nowadays cost of printing compels editors to delete data essential to those doing related researches. Conversely, much material of no interest outside a small circle is published merely because this small group must have the material if research is to move forward. If editors knew that such data were already in the hands of those who would use them, or were readily available, they could then proceed to increase the utility of their journals to the general run of their readers. Perhaps this might permit sufficient condensation of the material published to pay for the microfilm or photostat copies needed by specialists. It would increase reader use and appreciation, and so, circulation—again, in turn, easing financial problems.

The wartime necessity for contracting publication can, in fact, be a blessing in disguise. Most people feel that much material—always, of course, other people's copy—appears in the scientific journals which should be edited out. Most editors would do more and better editing if they had the courage that their judgment dictates. Nevertheless, few scientific men realize how much improvement more and better editing could bring about. Authors who finally manage to "get their papers off" are stale and unable to go further in their presentation. After the author has done all he can to a paper, it can be improved by another hand. I remember when a friend of mine took a position on the staff of one of the leading magazines he told his chief, "I can write and I can edit, but one thing I can not do is to edit my own copy." The services of a good editor, though seldom enjoyable, are of inestimable value to any author. The most skilful of writers are no exception. One of the best of these once wrote a letter to the *Reader's Digest* somewhat in this wise, "I thought it was all well enough for you to

compress the work of ordinary writers into a third of the space it took originally, but I write carefully, weighing every word, and I knew that no such liberties could be taken with my stories without destroying them. I was, therefore, indignant when I heard you had done it also to me—but I must confess that you improved my work."

The most notable event among the popular magazines of the last decade has been the phenomenal success of the *Reader's Digest,* which has not only outstripped in popularity all the old-line magazines in its general field, but has driven several of them to the wall. Indeed, some of those magazines which survive do so only from the proceeds of abstracting rights sold to the *Reader's Digest.* It is noteworthy that the advertising carried by the old-line magazines does not suffice to save them. It would be worth while for the scientific journals to study the factors in the success of the *Reader's Digest.*

If one takes the trouble to compare the abridged articles of the *Reader's Digest* with their originals, he finds not only that often nothing has been lost by abbreviation, but that frequently something has been gained. Could research papers be improved by similar treatment? For the most part, I believe that they could except for the few investigators in cognate fields who must have detail. Skilful editing by one closely in touch with the science concerned could solve the problems of many a journal.

Another strong factor is operating to compel condensation of scientific publication. No man can read all the material published even in a small field. If the volume of publication is reduced, there will be better support for what remains.

After the editor has done his work, still further economies (and improvements) can be made in type and format. Scientific periodicals have made very great progress toward better printing in the last decade. But there are still very great differences in the printing of scientific publications. Study of the organs of the member societies of the Division of Biology and Agriculture of the National Research Council reveals that some of them get three times as much print onto a square foot of paper as others. Clearly a good deal of improvement could be made here.

Recent researches into the visual task imposed by reading point the way to further improvements beyond the best of our scientific serials to-day. Matters concerning type and format, however, can not be profitably discussed within the limits of this paper. The means of meeting congestion and delay in publication here advocated are, however, independent of typography or format. It is believed an effective advance notification service would permit substantial contraction (without loss to science) of published papers. This would be brought about by prompt publication of advance abstracts of researches as soon as completed accompanied by wide availability of copies, by microfilm or otherwise, of the manuscripts to those directly concerned.

ROBERT F. GRIGGS
DIVISION OF BIOLOGY AND AGRICULTURE,
NATIONAL RESEARCH COUNCIL

SCIENTIFIC BOOKS

CHEMISTRY

Organic Chemistry for the Laboratory. By C. W. PORTER and T. D. STEWART. vi + 222 pp. 5½ × 9 in. The Athenaeum Press. Boston, New York, etc.: Ginn and Company. 1943. $2.00.

THIS little manual has been prepared as a guide for an introductory laboratory course in organic chemistry. As the authors explain in their preface, the manual provides for work extending through a period of one year, but it is particularly designed for a half-year course of thirty to forty laboratory periods. The manual is divided into four sections: I. General Directions; II. Experiments; III. Mechanical Operations; IV. Appendix. The first section is very brief (5 pp.), and the next section (154 pp.), comprising theoretical discussions and laboratory procedures for some fifty experiments, divided about equally between aliphatic and aromatic compounds, constitutes the main part of the manual. After the first three experiments, "Distillation," "Crystallization" and "Qualitative Tests for the Elements," the experiments are largely of the preparative type and similar in nature and arrangement to those that are to be found in other organic laboratory manuals. Optional procedures and short "reaction" experiments frequently follow the preparation directions. The latter are quite explicit in the earlier experiments and are given in more general terms as the student advances. Most of the experiments end with a set of five or six suggestive and helpful problems. The experimental section is concluded with a very brief discussion and series of tests on "The Classification and Identification of Compounds."

The third section (51 pp.) presents a simple and straightforward discussion of the theory and principles underlying the following mechanical operations: "Distillation," "Extraction," "Filtration," "Crystallization," "Sublimation," "Determination of Boiling Point," "Determination of Melting Point," "Calibration and Use of Thermometers" and "Methods of Dry-

ing." The discussion includes a brief review of the apparatus that is used in each operation. The Appendix (4 pp.) includes the methods of preparing the various indicators, reagents and solvents used throughout the manual.

The reviewer feels that the manual is a worthy companion to the text "Organic Chemistry" by Porter and Stewart (Ginn and Company, 1943) and that it should be very useful in an elementary organic course of the type for which it has been designed. The diagrams throughout the manual are entirely adequate, and the paper, press work and binding are very good.

CHARLES R. DAWSON

COLUMBIA UNIVERSITY

Second Year College Chemistry. By W. H. CHAPIN and L. E. STEINER. New York: John Wiley and Sons, Inc. Fifth edition. 575 pages. 1943. $3.75.

SCHOLARLY additions by the junior author give this text better balance of subject-matter than its predecessors. Although sequence of topics remains the same, much material appears for the first time. This includes a more rigorous correlation between the physics and chemistry of liquids and of solids; new mathematical derivations inserted in smaller type for the abler student; 165 miscellaneous problems in the appendix; crystal structure with splendid diagrams and an excellent discussion of ionic and covalent radii; mathematical derivation of the law of radioactive decay; descriptive material on tracer isotopes; and a detailed treatment of the Brønsted system of acids and bases.

The preface states that "the kinetic point of view is maintained throughout." For this reason it might have been advisable to include such subjects as reaction rates and the simpler aspects of quantum and statistical mechanics and the use of potential energy curves in this otherwise well-rounded, valuable text.

HUBERT N. ALYEA

PRINCETON, N. J.

General Chemistry. By HORACE G. DEMING. New York: John Wiley and Sons, Inc. Fifth edition. 706 pages. 1943. $3.75.

COMPLETELY rewritten, the new edition still emphasizes physical chemistry aspects, an approach for which Professor Deming has gained a worthy reputation. As such the treatment should appeal particularly to students in engineering. Rearrangement in order of topics has been extensive, with chapters on the atmosphere, the periodic table, atomic structure and pH appearing much earlier than in the fourth edition. Discussion of principles is curtailed somewhat to provide room for approximately a hundred pages of new material on industrial chemistry in the war effort: plastics, elastomers, ceramics, hydrogenations, light metals, detergents, and so forth. Once again the author has given us a top-notch, up-to-the-minute text.

HUBERT N. ALYEA

PRINCETON, N. J.

AUDIOMETRY

Clinical Audiometry. By C. C. BUNCH. Pp. 186. Illustrated. St. Louis: The C. V. Mosby Company. 1943. $4.00.

This is an intensely personal account of the author's life work—the development and use of the audiometer and the obtaining of countless audiograms. The sudden and untimely death of the author, just after completion of the manuscript, probably accounts for the frequent repetitions, quick digressions and returns that might have been eliminated in a final "polishing off."

The point of view of the book is highly specialized and does not extend far into any of the related fields of physics, physiology, psychology or clinical otology. For example, the author does not accurately explain or define the decibel, although it is now the accepted unit of measurement of hearing loss.

It is surprising, also, that no mention is made of the calibration of an audiometer, or of the range of variation of "normal" thresholds, or of possible differences in calibration of different commercial instruments.

In spite of its shortcomings, however, the book will remain a valuable record of the development of audiometry and of Dr. Bunch's extensive acquaintance with human auditory function.

HALLOWELL DAVIS

HARVARD MEDICAL SCHOOL

REPORTS

DOCTORATES IN SCIENCE[1]

BOTH the total number of doctorates granted in all fields of knowledge, including the sciences, and the total granted in the sciences alone reached an all-time high in the 1940–41 academic year. In all fields together the decline was about 9 per cent. from 1941 to 1942 and 17 per cent. from 1942 to 1943. In the group of the sciences alone, the decline was about 10 per cent. from 1941 to 1942 and 16 per cent. from 1942 to 1943. These figures are surprisingly uniform. They reflect an interestingly stable relation between the sciences as a group on the one hand and the social sciences and humanities as a group on the other. For

[1] Based upon "Doctoral Dissertations Accepted by American Universities, No. 10, 1942/43." New York: H. W. Wilson Company. 1943.

all doctorates granted in the last ten years, the median has been 56.6 per cent. in the sciences and 43.4 per cent. in the social sciences and humanities. The maximum variation either way in any one year was less than 2 per cent.

Full tables of science dissertations for the nine years from 1934 to 1942 were printed in SCIENCE a year ago (97: 333–5). We will not repeat them. We show here only the figures for the past three years in which the decline has been taking place. Table 1 is arranged in order of the 1943 ranking of the various sciences.

TABLE 1

	1941	1942	1943
Chemistry	672	588	538
Biochemistry	116	138	129
Physics	191	146	124
Zoology	125	110	103
Psychology	117	125	95
Botany	102	120	89
Agriculture	78	55	61
Bacteriology and microbiology	71	69	56
Physiology	77	66	49
Mathematics	95	85	44
Geology	53	56	36
Entomology	46	44	32
Pharmacology	31	31	29
Genetics	31	23	29
Engineering	76	47	22
Horticulture	23	21	14
Astronomy	11	7	14
Metallurgy	17	11	13
Anthropology	19	14	12
Geography	16	16	10
Anatomy	18	16	10
Medicine and surgery	18	15	10
Public health	15	14	6
Mineralogy	3	6	4
Paleontology	11	6	3
Meteorology	1	3	2
Seismology	1	1	1
	2034	1833	1535

Chemistry and its near-twin biochemistry lead the group in 1943, biochemistry having for the first time taken the lead over physics, which has been in the second place for several years. Chemistry, however, is increasing steadily in relation to all other doctorates granted. In 1939 it was 16 per cent. of the total. In 1940 it was 17 per cent.; in 1941, 18 per cent.; in 1942, 19 per cent., and in 1943, a full 20 per cent. It now totals more than a third of all science doctorates granted in 1943. If biochemistry were to be added in, the percentage would be still higher.

It might be interesting to observe what universities gave 25 or more doctorates in the sciences as a group in 1943.

TABLE 2

1.	Minnesota	91	12.	Iowa State	47
2.	Cornell	87	13.	Massachusetts Institute of Technology	47
3.	Wisconsin	84			
4.	California	74	14.	Harvard	39
5.	Columbia	71	15.	Pennsylvania	31
6.	Chicago	58	16.	Maryland	27
7.	Illinois	57	17.	New York	27
8.	Michigan	55	18.	Northwestern	25
9.	Ohio	54	19.	Purdue	25
10.	Iowa	49	20.	Texas	25
11.	Pennsylvania State.	48			

A comparison of Table 2 with Table 2 in last year's SCIENCE is interesting. Chicago has taken a big drop from 114 science dissertations to only 58. Minnesota, Cornell, Pennsylvania State and Texas gave more science doctorates in 1943 than in 1942. Every other institution gave fewer. When the 1943 totals are added to the nine-year totals given in last year's SCIENCE, the standings are:

1.	Cornell	886
2.	Wisconsin	879
3.	Chicago	857
4.	Columbia	755
5.	Illinois	741
6.	Michigan	740
7.	California	723

There are no significant changes of order below the seventh place.

One fact of some interest is that in 1943 forty-three dissertations were reported as "Secret war research." Of these, twenty-two were in chemistry, sixteen in physics, two in psychology and one each in pharmacology, physiology and zoology.

This report makes it clear that the war emergency is seriously reducing the output of doctorates in American universities. Perhaps this is as it should be. However, it is a situation that will demand early attention when the emergency is over because most of our technical and industrial advance ultimately depends upon scientific research in our universities. We are, of course, quite aware that many industries have their own research laboratories, but these depend for manpower upon the output of doctors from the universities.

EDWARD A. HENRY

UNIVERSITY OF CINCINNATI

SPECIAL ARTICLES

A FILTERABLE VIRUS ISOLATED FROM A CASE OF KAPOSI'S VARICELLIFORM ERUPTION

KAPOSI'S varicelliform eruption is a comparatively rare exanthem occurring in patients with atopic eczema. The condition is characterized by high fever for from 4 to 7 days, by leucopenia and by the presence of umbilicated vesicles, some of which may become pustular, involving only the eczematous portions of the skin. The disease is self-limited, and the prognosis is good.

A filterable[1] virus was isolated from the skin lesions of a 15-month-old child showing a clinical picture typical of Kaposi's varicelliform eruption. Fluid removed from cutaneous vesicles was inoculated on the

[1] Berkefeld fine, V–13.

cornea of a rabbit. Within 3 days lesions were noted. On the fourth day the rabbit cornea was removed, carefully washed in sterile saline and triturated in tryptose-phosphate broth in an agate mortar. After centrifugation, the supernatant fluid was Seitz-filtered and inoculated into mice intracerebrally and onto the retracted chorioallantois of embryonated hen's eggs. Blood agar cultures of the inoculum, aerobic and microaerophilic, were sterile. In 2 to 4 days the mice so inoculated developed convulsions and died. By the fourth day numerous small, opaque, pock-like lesions were observed on the chorioallantoic membranes. The strain has been perpetuated readily by egg and mouse passage. Other samples of vesicular fluid inoculated directly onto the retracted chorioallantoic membrane produced small pock-like lesions in 4 to 5 days. There was no evidence of bacterial infection, and all cultures were consistently negative. The egg strain has been maintained in serial passage on the chorioallantois (6 passages), and transfer from these eggs to mice and to rabbit's cornea gave results identical with the foregoing.

These two strains of virus, one isolated primarily by means of the rabbit's cornea and the other isolated primarily on the chorioallantois, gave similar results in all studies. Both strains have been well established in mice: the egg strain transferred to mice and carried at the present writing for 6 passages, the rabbit strain transferred to mice and carried for 7 passages. Thus far, it has been established by repeated tests that the virus when injected intracerebrally into mice produces convulsions and death in from 2 to 7 days in dilutions of 10^{-1} through 10^{-5}. Detailed titration studies are in progress, but as yet the minimal lethal dose has not been determined definitely. Mouse protection tests using sera of the patient demonstrate increasing titre of antibody to this infectious agent. Serum taken at 15 days and at 30 days after onset of illness showed high protective titre.

The lesions on the chorioallantoic membrane are

Dilutions of Virus	Patient's Serum I 7 days after onset	Patient's Serum III 15 days after onset	Patient's Serum IV 17 days after onset	Patient's Serum V 30 days after onset	Control Broth	Normal Human Serum
10^{-2}	4 4 / 5 7	□ □ / □ □	T 10 / □ □	T □ / □ □	3 3 / 3 3	4 4 / 4 5
10^{-3}	7 7 / 7 7	□ □ / □ □	□ □ / □ □	□ □ / □ □	4 4 / 4 4	5 5 / 5 5
10^{-4}	6 7 / □ □	□ □ / □ □	□ □ / □ □	T □ / □ □	4 4 / 5 5	7 7 / 7 8
10^{-5}	□ □ / □ □	□ □ / □ □	□ □ / □ □	□ □ / □ □	5 5 / 6 7	8 8 / 8 8

□ = Survived

T = Died trauma

○ = Died in convulsions, figure within circle indicating day of death

FIG. 1. Mouse Protection Test. Serum-Virus Mixtures Incubated at 37° C. for 2 Hours. Inoculation, 0.03 ml. IC.

small, opaque, whitish pocks which are discrete and can be seen with the unaided eye. Microscopic section reveals the presence of cellular proliferation in the ectodermal layer of the chorioallantois, of marked cellular proliferation in the mesoderm with considerable cellular infiltration, and a slight proliferation of the endodermal layer. Section of rabbit's cornea also shows considerable epithelial cell proliferation. In the mouse brain an encephalitic process is noted. Detailed histological studies are under way, and experimental work is in progress with a view to establishing the identity of the virus.

RUSSELL J. BLATTNER
FLORENCE M. HEYS
MARY LOU K. HARRISON

DEPARTMENT OF PEDIATRICS,
WASHINGTON UNIVERSITY SCHOOL OF MEDICINE
AND THE
ST. LOUIS CHILDREN'S HOSPITAL,
ST. LOUIS, MISSOURI

VARIABILITY OF THEILER'S VIRUS OF MOUSE ENCEPHALOMYELITIS[1]

ONE of the accepted characteristics of Theiler's virus[2] in albino mice is the high potency of the infectious agent—as demonstrated by intracerebral injection—and its limited infectivity—as determined by intraperitoneal inoculation. In other words, while the virus will abundantly multiply when sowed directly upon susceptible nerve tissue, it evidently has but little ability to reach the same tissue from peripheral channels of infection. The reasons for this discrepancy are not clear. For instance, the virus could be restrained in peripheral invasion by whatever individual protection the immune mouse may interpose; however, the response of Theiler-free cotton rats to intraperitoneal injection does not differ from that of Theiler-carrying albino mice. We are therefore dealing with an intrinsic property of the viral agent itself, probably brought about by prolonged interaction between virus and herd immunity within its natural host.

When Theiler's virus (GDVII strain) is serially passed through cotton rats, the virus will, on certain occasions, mutate and exhibit new biological properties.[3] For instance, cotton rat variants thus produced possess marked peripheral invasiveness for both cotton rats and albino mice; they may also prove capable of paralyzing other hosts, normally refractory to infection with Theiler's mouse virus, such as guinea pigs and rhesus monkeys. Data have recently been collected which show that similar changes can occur spontaneously during rapid mouse-passages of Theiler's virus (GDVII strain), especially following *in vitro* contact with certain normal sera. It is the object of this communication to briefly report these observations.

It has been our practice to maintain the virus in albino mice by serial intracerebral passage, transfers being usually separated by intervals of from two to four weeks. Occasional titrations over a period of almost two years indicated some fluctuation in potency, but, in general, the virus preserved its high intracerebral titer (10^{-6} to 10^{-8}) without gaining appreciably in virulence by intraperitoneal inoculation (10^{-1}). Irregularities were first observed when virus was harvested from mice—serving as controls in neutralization tests—which had become paralyzed following intraperitoneal injection with mixtures of virus and certain normal sera (rabbit, horse, guinea pig, man). The brains of such mice, on subsequent titration, often contained virus capable of paralyzing albino mice, intracerebrally as well as intraperitoneally, in extremely high dilutions. It was not immediately clear whether the observed phenomenon had occurred: (1) as the result of previous contact between virus and serum, (2) because virus was used which had been collected from intraperitoneally injected mice, or, (3) whether the rapid transfer of virus attending these operations, irrespective of derivation, had served to increase its virulence. Investigation of the three possibilities led to the following results: Ten experiments were carried out in which virus was exposed to contact with normal serum by means of intraperitoneal injection of virus-serum mixtures; in seven instances virus obtained from the brains of paralyzed mice reached intraperitoneal titers between 10^{-3} and 10^{-10}. Four experiments were run in which contact between virus and serum was established by intracerebral injection of virus-serum mixtures; in two instances titration of the resulting virus brains revealed intraperitoneal titers between 10^{-3} and 10^{-8}. Four experiments were finally conducted in which virus was passed rapidly, without serum contact, by either intracerebral or intraperitoneal injection. These last experiments were synchronous with an equal number of experiments in which virus was being transferred in combination with serum, the same batch of virus serving as source for both series. In one instance the virus showed unmistakable evidence of an increase in intraperitoneal titer (10^{-9}).

The use of the different methods mentioned yielded a total of ten viral substrains, all of which possessed high intraperitoneal potency for albino mice. When passed over three to five subsequent mouse-passages

[1] Aided by grants from the Dr. Philip Hanson Hiss, Jr., Memorial Fund, the Warner Institute for Therapeutic Research and anonymous donors.

[2] M. Theiler, SCIENCE, 80: 122, 1934; M. Theiler and S. Gard, *Jour. Exp. Med.*, 72: 49, 1940.

[3] C. W. Jungeblut, *Am. Jour. Publ. Health*, 33: 1227, 1943.

without serum, none of these strains suffered any loss of their enhanced peripheral titer. Furthermore, protracted contact of such virus with sub-effective doses of an antiserum prepared by immunization of rabbits against one of the invasive strains failed to bring about a reversion to non-invasiveness. From what has been said it is obvious that the described variation is clear-cut and permanent when it takes place; however, the occurrence of failures on repetition under identical experimental conditions attests to the unpredictable nature of the biological process involved.

Serological tests were performed in order to determine the identity of one of the new viral forms produced by contact with normal rabbit serum. As may be seen from Table 1, the non-invasive standard

TABLE 1

CROSS NEUTRALIZATION OF NON-INVASIVE AND INVASIVE STRAINS OF THEILER'S VIRUS BY CORRESPONDING ANTIVIRAL IMMUNE RABBIT SERA IN INTRACEREBRAL AND INTRAPERITONEAL TESTS

Theiler's virus		Antiserum against non-invasive strain		Antiserum against invasive strain	
		Minimum lethal doses neutralized		Minimum lethal doses neutralized	
Phase	Potency	Intracerebrally	Intraperitoneally	Intracerebrally	Intraperitoneally
Non-invasive parent virus	i.c. 10^{-7} i.p. 10^{-1}	10^{1}	10^{4*}	10^{1}	10^{4*}
Invasive variant virus	i.c. 10^{-10} i.p. 10^{-9}	10^{4}	10^{10}†	10^{4}	10^{10}†

* Serum neutralized up to 1 : 1000 dilution.
† Serum neutralized up to 1 : 10 dilution.

GDVII strain was neutralized quantitatively as well by its homologus antiserum as by a hyperimmune serum produced against the invasive strain. Conversely, neutralization of the invasive strain by its homologous antiserum occurred at the same levels as that obtained with anti-GDVII serum. Neither strain of Theiler's virus, invasive or non-invasive, was neutralized when tested intraperitoneally with antisera produced against two strains of mouse-adapted human poliomyelitis virus (SK, MM).[4,5] It is clear from these data that the invasive variant of Theiler's virus was serologically indistinguishable from the non-invasive parent strain. It is also obvious that the invasive Theiler strain did not result from chance contamination with murine SK or MM virus.

In summary it may be said that rapid passage in mice of Theiler's virus of mouse encephalomyelitis induces, on certain occasions, a variation of the infectious agent. The most characteristic feature of this variation is an enhancement in the power of the virus to invade the central nervous system from peripheral channels of infection. The phenomenon apparently is aided by previous contact of virus with certain normal sera. The resulting variant seems to be stable since it retains its newly acquired properties over several mouse-passages. The available serological evidence indicates that the invasive strain is antigenically identical with the non-invasive present strain. The reported data support earlier observations on biological changes of Theiler's virus and throw new light on the inherent variability of the viruses belonging to the poliomyelitis group.

Grateful acknowledgment is made of the assistance of Mr. Frank Vasi in the course of this work.

CLAUS W. JUNGEBLUT

DEPARTMENT OF BACTERIOLOGY,
COLLEGE OF PHYSICIANS AND SURGEONS,
COLUMBIA UNIVERSITY

[4] C. W. Jungeblut, M. Sanders and R. Feiner, *Jour. Exp. Med.*, 75: 611, 1942.

[5] C. W. Jungeblut and G. Dalldorf, *Am. Jour. Publ. Health*, 33: 169, 1943; C. W. Jungeblut, *Am. Jour. Publ. Health*, 34: 259, 1944.

FRUCTOSAN, A RESERVE CARBOHYDRATE IN GUAYULE, PARTHENIUM ARGENTATUM GRAY

IN the course of investigations on the carbohydrate metabolism of the rubber-producing plant guayule, indirect evidence was obtained for the presence of a polysaccharide having the properties of a fructosan. This constituent was isolated and identified as follows:

Two hundred grams of dry coarsely ground mixed guayule tissue was extracted with 80 per cent. ethanol until the percolate was colorless. The tissue was air dried, and extracted with 5 separate 300 ml portions of water at the temperature of the boiling water bath. The combined dark-colored water extract was then treated with excess neutral lead acetate, centrifuged, and deleaded with H_2S. After adjustment to pH 6, the solution was decolorized with charcoal at about 80° C and concentrated to 100 ml under reduced pressure.

Addition of 3 volumes of acetone to the concentrate caused the formation of a white precipitate, which was allowed to flocculate in an ice bath. This precipitate was centrifuged down, taken up in water at 80° C, treated with charcoal, and again precipitated with acetone in the cold. The resultant floc was taken up in water, treated with lead acetate, deleaded, and precipitated with acetone. After washing with acetone, the substance (I) was dried under vacuum.

The substance (I) was practically insoluble in water at room temperature, but dissolved readily in hot water to give a clear solution. It showed no color change with iodine, and was non-reducing. On mild acid hydrolysis the substance (I) gave rise to a

strongly reducing substance, II. Both I and II showed positive ketose tests with Seliwanoff's reagent, and were levorotatory. The osazone of II was identical with that of fructose.

On the basis of the above observations it is concluded that fructosan is one of the carbohydrate constituents of guayule. In so far as tests conducted to date indicate, this polysaccharide (I) appears to be inulin,[1] but its exact constitution remains to be determined.

Using a colorimetric method, values for the fructosan content in the stem and roots of guayule have ranged from 0.2 to 12 per cent. (dry weight basis), depending on the conditions under which the plants were grown. Evidence that this polysaccharide is the chief storage carbohydrate in this species will be presented in detail elsewhere.

WILLARD L. MCRARY
HAMILTON P. TRAUB

U. S. DEPARTMENT OF AGRICULTURE,
AGRICULTURAL RESEARCH ADMINISTRATION,
BUREAU OF PLANT INDUSTRY, SOILS AND
AGRICULTURAL ENGINEERING
GUAYULE RESEARCH PROJECT,
SALINAS, CALIF.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

NUCLEAR BEHAVIOR IN RELATION TO CULTURE METHODS FOR PENICILLIUM NOTATUM WESTLING

DIFFERENCES in the yield of penicillin from *Penicillium notatum* Westling occur among strains or in subcultures of the same strain, even when grown from single spore isolations. Clutterbuck, Lovell and Raistrick[1] reported difficulty in maintaining Fleming's strain of *P. notatum*. Currently Hansen and Snyder[2] attribute this variation to the dual phenomenon which they have found to be characteristic of many fungi.[3] To maintain an active culture these authors recommend selection of a suitable strain following single spore isolation and tests for yield. Subsequent transfers can then be made by mass spore transfer.

Foster *et al.*[4] recommend merely the selection of a high potency strain and its maintenance by mass spore transfers. An analysis of the 19 substrains they derived from 3 different parent colonies clearly suggests that association and dissociation of genetic factors can not be overlooked as an explanation of the varied results recorded by these and other investigators.

In none of these accounts has the nuclear behavior been taken into consideration. If heterokaryosis or the interaction of genetically different haploid nuclei in the same mycelium is responsible for the variation in penicillin production it is necessary to know whether *P. notatum* has a nuclear cycle capable of such behavior. The details of a cytological investigation of this fungus are now in press, to be published shortly.[5] It will suffice here to say that the conidia of this fungus are predominantly uninucleate although occasionally binucleate conidia occur. Using C and M to designate types, single conidia then could comprise either of these genetic factors or their possible combinations: C, M, CM, CC or MM, depending on the number of nuclei per conidium. If a spore is heterotypic then the genetic means of variation are present from the outset. If it is homotypic presumably the line can be developed monotypically provided no mutations occur. However, in mass spore transfers a few hours after germination there is marked anastomosis among the developing germ tubes, conidia and mycelia, giving abundant opportunity for nuclear interchange. Since analysis of cultural isolates indicates that the variations are due to a mixture of genetic factors following anastomosis and the establishment of heterokaryosis, it would appear that at present mass spore transfer methods would offer as certain a way as any of keeping active cultures. Unless a spore is binucleate and heterotypic, an infrequent condition in this fungus, the effect of heterokaryosis is eliminated by single spore transfer. Mass spore transfer increases the chances of nuclear mixing and consequently heterokaryotic vigor.

GLADYS E. BAKER

PLANT SCIENCE DEPARTMENT,
VASSAR COLLEGE

[1] After this note was submitted for publication, an incidental statement (not supported by data) to the effect that inulin occurs in guayule was found in a report of the Experimental Chemical Laboratory of the Italian Ministry of War (Silvio Guglielminetti, *Azzurra Agricola-Floreale*, 16: 63, 1936).

[1] P. W. Clutterbuck, R. Lovell and H. Raistrick, *Biochem. Jour.*, 26: 1907, 1932.

[2] H. N. Hansen and W. C. Snyder, SCIENCE, 99: 264, 1944.

[3] H. N. Hansen, *Mycologia*, 30: 442, 1938.

[4] J. W. Foster, H. B. Woodruff and L. E. McDaniel, *Jour. Bact.*, 46: 421, 1943.

[5] G. E. Baker, *Bull. Torrey Bot. Club*. In press.

BOOKS RECEIVED

ANDRES, PAUL G., HUGH J. MISER and HAIM REINGOLD. *Basic Mathematics*. Illustrated. Pp. x + 726. John Wiley and Sons, Inc. $4.00.

GRAHAM, EDWARD H. *Natural Principles of Land Use*. Illustrated. Pp. xiii + 274. Oxford University Press. $3.50.

SMITH, GILBERT. *Marine Algae of the Monterey Peninsula*. Illustrated. Pp. ix + 622. Stanford University Press. $6.00.

YOST, DON M. and HORACE RUSSELL, JR. *Systematic Inorganic Chemistry*. Illustrated. Pp. xx + 423. Prentice-Hall. $4.60.